dissected Flysch-zone, and that the contrast between the surface of the young folded chain and that of the old "Rumpf" of Bohemia is in reality a development of fairly recent times. The Alps, moreover (p. 18), appear to have gained in height, by a vertical movement, since the formation of the interglacial lakes, and thus their present preeminence is not to be ascribed to lateral thrust alone.

The uniformity of level of peaks in the same district is then discussed, and it is argued that the cutting of valleys in a mass undergoing denudation influences the heights of the peaks along the valley-walls. After a long time, where the hardnesses of the rocks concerned do not greatly vary, the upstanding points at any given distance from the centre of the chain will tend to be reduced to much the same level above the sea, and the impression given will be that they were originally points on a continuous dome. It is clear that the author here asks us to be cautious in applying the fascinating doctrine of the "peneplain" and of subsequent elevation to every dissected highland.

The consideration of the post-Pliocene uplift leads us on to the vigorous and partly post-Roman depression of the Adriatic region, with the compensating elevation of the Apennines; then follows a survey of river-courses in central Europe. The movement of masses of land in vertical blocks, to which geomorphological studies in the Alps have directed attention (p. 36), is shown not to be inconsistent with horizontal movements, and with folding, where one block rides over another (p. 34). The relative importance of vertical movement and horizontal thrusting, and how far the one may be a manifestation of the other, are left as problems for the future.

So far, the results of recent observation, geographical it may be, but with a remarkably geological trend, have been summarised for the region of which Vienna is the natural centre. A few words in praise of observational research conclude this section. The title of the pamphlet is, however, really justified in the discourse to the students of Berlin, which opens with a somewhat depressing picture of their natural environment. Men, not mountains, have made the greatness of the geographical school of northern Germany. Prof. Penck contrasts the influence of Karl Ritter, who regarded the earth from the point of view of its suitability for man, with the later and more scientific attitude of von Richthofen. In each case the geographical outlook depended on the stage reached contemporaneously in the development of scientific thought. Ritter expressed (p. 47) the teleological views of his time; Richthofen "nimmt die Erdoberfläche nicht als gegeben, sondern als geworden, naturgemäss daher bei ihm die enge Fühlung zwischen Geographie und Geologie." Followers of Richthofen should insist on being observers, not mere critics and coordinators. Modern means of communication have made travel a matter of money only, instead of both time and money, as in bygone years. The small scale of the maps of the more recently explored countries masks the immense amount of work that is waiting to be done, and the district adjacent to a colonial railway station may well reward the student who goes out skilled in observation. With such stimulating words Prof. Penck enters on his new province in Berlin, and he may be sure that his friends in the four corners of the world will welcome those whom he has trained.

GRENVILLE A. J. COLE.

THE STRENGTH OF MATERIALS.

Text-book on the Strength of Materials. By S. E. Slocum and E. L. Hancock. Pp. xii+314. (Boston and London: Ginn and Co., n.d.) Price 12*s.* 6*d.*

THIS book is intended to provide for the needs of engineering students both in the class-room and in the laboratory; hence it is divided into two parts, the first part treating of the theoretical side of the subject and the second dealing with the experimental side. The first two chapters are devoted to a general discussion of the relations between stress and strain as an introduction to the development of the more special rules applicable to the structural forms in common use by engineers and architects. There is an unfortunate slip on p. 10 in the paragraph dealing with the fatigue of metals; in quoting some of the results obtained by Bauschinger in his experiments, the material is stated to have been "cast iron"—it was, of course, "wrought iron." Chapters iii. and iv. deal with stresses and strains in beams, and there are two useful constructions not usually found in text-books on this subject, namely, a graphical method of finding the centre of gravity and the moment of inertia for a rail, or other similar section, and a graphical solution of the problem of finding the moment of inertia of a reinforced concrete beam of rectangular cross-section.

In dealing with the flexure of beams in chapter iv., the problem of continuous beams is fully discussed, and, in addition to the method of three moments, other methods of solution of the problem, based on Maxwell's theorem and on Castigliano's theorem, are explained.

In the next two chapters the design of struts and shafts is dealt with, also the theorem of helical springs, but there is nothing novel in the treatment of any of the problems which have to be solved.

In the chapter which treats of the strength of spheres and cylinders under uniform pressure, a neat formula is obtained for the critical pressure just preceding collapse in the case of a hollow circular cylinder subjected to external pressure, and Lamé's formula for thick cylinders is deduced.

Two subjects—flat plates and hooks—which in most of the text-books are usually treated in a somewhat unsatisfactory fashion are thoroughly investigated in chapters viii. and ix.; in the case of crane hooks it is pointed out that the ordinary assumption that the distribution of stress is the same as in a straight beam subjected to an equal bending moment and axial load is not even approximately correct. From an analysis of the stresses in a curved piece subject to pure bending strain, a general formula for

the case of a crane hook is deduced, and the method of Résal is explained by which the application of the formula is much simplified. The last two chapters of this section are devoted to arches and arched ribs, and to foundation and retaining walls; this is a part of the subject of the strength of materials which generally proves a great stumbling-block to the engineering student, and the authors are to be congratulated on the lucid and thorough fashion in which they have set forth the various solutions which have been found most satisfactory for problems which have been well-known subjects of controversy among engineers and mathematicians for a century or more.

The six chapters of part ii. are devoted to the physical properties of materials and the most modern methods of determining accurately the various physical constants required in the formulæ of part i. Typical testing machines are illustrated and explained, and the various types of apparatus in general use for measuring the stresses in the material undergoing test are described. The materials dealt with include iron and steel, reinforced concrete, and the other building materials employed by engineers and architects; a number of useful tables are given, and also the standard specifications proposed by the American Society for Testing Materials.

The authors have succeeded in producing a new English text-book in which the important subject of the strength of materials, the foundation upon which the whole structure of engineering science is based, is treated in a far more complete and thorough fashion than has been the case in the majority of the text-books hitherto available to the engineering student, and certain sections of it should prove of great service to those who are actively engaged in engineering design.

SCIENCE IN POETRY.

Nature Knowledge in Modern Poetry. By Alexander Mackie. Pp. vii+132. (London: Longmans, Green and Co., 1906.) Price 2*s.* 6*d.* net.

IN this book the author deals in a very interesting manner with the many references to the aspects of nature in the poetical works of Tennyson, Wordsworth, Matthew Arnold, and Lowell.

We find these poets taking delight in alluding to animated nature in many different ways. Not only do flowers, trees, and foliage of all kinds occupy a prominent place in their poems, but animal life figures almost as importantly, birds more especially.

Tennyson's references to horses and dogs show an intimate knowledge of these animals, though they do not convey the spirit of one in the habit of taking part in sport; and the author points out that Tennyson was not a sportsman. Matthew Arnold's love of dogs is also very obvious, and his poems show how much sympathy he had with them, and what a close observer he was of their ways and habits. This comes out more especially in the poems dedicated to his household pets.

Interest in the insect world is shown to a greater extent by Tennyson, for he alludes to it frequently, and always with the accuracy which reveals great knowledge. Lowell refers more especially to the bee.

Love of bird life is common to all these poets, but it is worthy of note, and also pointed out by the author, that the great characteristic of Tennyson's work is that he describes the bird's *notes* to a great extent, and has the happy knack of so doing that the bird he is referring to is unmistakable.

We gather in many ways that Tennyson was the more truly scientific man of the poets referred to. The character of his allusions and the accurate detail into which he goes are, moreover, beyond the knowledge of the casual observer. Wordsworth was more an ecstatic admirer; as the author tells us, "his outlook was broader, and in one sense less intimate" than Tennyson's. He was accurate in his descriptions, but seemed almost fearful lest an intimate knowledge should do away with the beauty and poetry of nature. He says,

> "Sweet is the lore which Nature brings;
> Our meddling intellect
> Misshapes the beauteous forms of things;
> We murder to dissect."

And again,

> "Enough of Science and of Art;
> Close up those barren leaves;
> Come forth and bring with you a heart
> That watches and receives."

In the preface to "This lawn a carpet all alive," Wordsworth appears a little more in sympathy with science, but in spite of this he still conveys the feeling that he is of opinion that nature will reveal her mysteries unsought.

Tennyson's love of geology is apparent in the frequent references to it and the similes he gives, which clearly show he must have read a good deal on this as indeed on many other less popular subjects; for instance, he does not shun allusions to the nebular hypothesis, spectrum analysis, and astronomy. It seems evident that he accepted the theory of evolution, for many quotations might be made to show it; but the author contents himself with the following, from "Locksley Hall Sixty Years After":—

> "Evolution ever climbing after some ideal good,
> And Reversion ever dragging Evolution in the mud.
> * * * * * *
> Many an aeon moulded earth before her highest, man, was born,
> Many an aeon too may pass when earth is manless and forlorn."

We see, therefore, that these poets deal largely with things of scientific interest, and all lovers of nature will find the book of great and permanent value.

OUR BOOK SHELF.

Geometrische Kristallographie. By Ernst Sommerfeldt. Pp. x+139; illustrated. (Leipzig: W. Engelmann, 1906.) Price 7*s.* net.

THE closing decade of the last century witnessed much progress made in the development of the geometrical theory of crystal structure, and we may now have confidence in the certainty of our knowledge regarding the possible types of crystalline